Fluid Phase Change

[thermal cooling products]

Fluid Phase Change applications, often referred to as "re-circulating," use closed loop heat pipes to transfer heat quickly through evaporation and condensation within the heat pipe.

Because of their high thermal efficiency, heat pipes are often designed into advanced heat sink technologies when increased thermal density or physical size restrictions exist.
Heat Pipes

Heat pipes are a transport mechanism to move heat from the hot source to an area where the heat can be dissipated. Heat pipes do not actually dissipate the heat and are therefore incorporated into many different types of heat sinks as helpers.

A heat pipe is a copper tube with an internal wick structure that is sealed on both ends with a small amount of water inside. As heat is applied to the pipe, the water will boil and turn to a gas, which then travels to the colder section of the heat pipe where it condenses back to a liquid. It is the evaporating and condensing of the water that form a pumping action to move the water (and thus the heat) from end to end of the pipe.

There are many types of wick structure that can be used within the heat pipe and they are generally classified into grooved, mesh, powder and hybrid. A grooved heat pipe is a copper tube with a series of shallow grooves around the internal perimeter of the heat pipe.

While the water is a liquid, it travels in the grooves and while it is a vapor it travels in the open space of the pipe. Grooved pipes can be used in horizontal orientations, but are very limited in performance if used about 15° out of horizontal.

A mesh heat pipe is a smooth wall copper tube with a woven copper mesh installed along the interior of the pipe. The mesh is designed to remain in contact with the walls of the pipe in areas where the pipe may be bent or flattened. Mesh pipes can be used in horizontal and orientations of about 30° out of horizontal.

A powder wick heat pipe can also be known as a sintered heat pipe. During the manufacturing process a mandrel is installed in the center of the pipe and copper powder is poured into the pipe around the mandrel. After the powder is sufficiently packed, the parts are placed into a sintering oven. Once at temperature, the copper powder will stick to the pipe and to itself, forming lots of internal pockets like a sponge. Because of the small pocket sizes, sintered pipes can efficiently move the water and can be used horizontally, vertically and all points in between including upside down.

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